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INSTITUTE OF GAS TECHNOLOGY

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Business Review of Gas

Banks, F. M. THE GAS INDUSTRY IN 1955. *Gas Age*, 115, 37-42 (1955) January 13.

The new AGA President reviews trends in sales, consumers, line extensions, gas reserves, promotion and advertising for the coming year.

R. T. Ellington

Fire Safety

GAS HAS EXCELLENT FIRE-SAFE RECORD IN LATEST FIGURES, FOR 1953. *Ind. Gas*, 33, 5 (1954) December.

National Fire Protection Association releases estimate for latest year, 1953; this compilation shows gas fuel and appliances as 18th in list of 24 causes. In estimates of fire losses among manufacturing plants, the worst record is shown by textiles, wood, grain and metal works.

Author's Abstract

1953 FIRE LOSS DISTRIBUTION CHART; STATISTICS PROVE THAT GAS IS THE SAFEST POPULAR FORM OF FUEL. *Butane-Propane News*, 17, 46-47 (1955) January.

The use of fuel gases domestically and industrially is relatively safer than other popular forms of fuel. Electrical fire losses are 5 times greater than those from gas fires.

W. G. Bair

Foreign Gas

Grant, J. D. GAS MANUFACTURE—A GLOBAL SURVEY. *Gas Times* (British), 82, 96, 101, 102, 104, 115, 116 (1955) January 21.

Gas making processes presently used in countries outside of Great Britain are reviewed and compared with those practiced in Britain. Historical factors which have influenced the structure of the gas industry in various parts of the world are traced. The effect of natural gas, liquid petroleum gases, and the shortage of good coking coals on the manufactured gas industry is shown. Some of the newer process for coal carbonization, coke gasification and complete coal gasification are described and illustrated. Underground gasification of coal is reported as being still investigated in several countries. It is concluded that the occurence of large supplies of natural gas can cause a rapid change in the structure of the manufactured gas industry of a country.

E. J. Pyrcioch

Future Energy Sources

Furnas, C. C. ENERGY SOURCES OF THE FUTURE. *Ind. Eng. Chem.* 46, 2446-57 (1955) December.

The author, an active student of the future of our energy-based civilization, presents as the Second I & EC Lecture his analysis of future energy sources, based upon the data presented by P. C. Putnam's book "Energy in the Future." Based upon trends of the last century, the world population of 2.4 billion today will increase to 6 to 8 billion in 2050. The U.S. population, about 160 million with a growth twice that of the world rate, will reach 375 million in 2050 even though the rate might drop to zero by that time. Energy demands will increase more rapidly than does population, because of trends from subsistence agriculture toward industry. Rate of increase of world energy utilization averaged 2.2% per year compounded since 1850, and now has reached 3%. The United States averaged 5.4% per year compounded during the past century. The total world consumption of energy during 1850-1950 was 4 quintillion Btu (4×10^{18}), the rate rising from 0.01 to 0.1 quintillion Btu per year, a ten-fold increase. The U.S. rate has risen from 0.003 in 1850 to 0.036 quintillion Btu in 1950. To meet the future, there remain fossil fuels (coal, oil and gas, recoverable at no more than twice 1950 costs) estimated at 27 q. Btu for the world and 4 q. Btu for the U.S. Also the two major untapped sources, 1) estimated recoverable uranium and thorium at one third effective burnup will yield 575 q. Btu total and 2) solar energy will yield 3200 q. Btu per year. During the life of the less-than-century remaining supply of fossil fuels, it is obvious that intensive basic research and engineering development are needed on nuclear power and solar energy to meet the expected ten-fold increase in energy demand by the end of the next century.

O. P. Brysch

Gas Price Future

Tippy, W. B. WHAT WILL HAPPEN TO THE PRICE OF GAS? *Gas* 31, 46-50 (1955) January.

The author believes that the price of natural

gas will ultimately come to rest at a balance point dictated by competition at the consumer level. He discusses the effect of various regulations upon this price, and feels that in the long run they will tend to have the effect of slowing up the rate at which price in the field approaches the competitive level.

Publishers' Abstract

Industry Financing

Buell, K. THE ROLE OF COMMERCIAL BANKS IN GAS INDUSTRY FINANCING. *Gas* 31, 126-128 (January 1955).

The gas industry is currently in the midst of a huge expansion program. Because of the relatively low amount of internal cash generated within the industry, it must depend largely on commercial banks to furnish short-term loans for capital expenditures. Types and availability of such loans are discussed by the author.

Publishers' Abstract

Wisconsin's Gas Supply

Durfee, J. R. WISCONSIN AND THE PHILLIPS CASE. *Publ. Util. Fortn.*, 55, 70-73 (1955) January 20.

A statement of the reasons why the State of Wisconsin started the legal proceedings in the Phillips case. The article is written by the Chairman of the Wisconsin Public Service Commission. Direct rebuttal of same of Phillip's public statements is made.

W. G. Bair

2. APPLIANCES

Air Conditioning

Herbst, R. S. (assigned to General Electric Co.) AIR CONDITIONING SYSTEM. U. S. 2,699,922 (1955) January 18.

The invention relates to the changeover operation from heating to cooling or vice-versa in an air conditioning system. Heating and cooling units are separate with individual fans and check dampers but connected to a common duct system. Changeover is effected by a selector switch operated manually. J. F. Reed

Kelley, G. A. and Rahm, H. E. (assigned to Surface Combustion Corp.) AIR CONDITIONER. U. S. 2,700,536 (1955) January 25.

This invention is concerned primarily with the 2 sumps in an air conditioner employing absorbent solutions for dehumidification. Sumps are provided with pumps to regenerator and contactor, and a weir and overflow can for the regulation of mixing and feed rates of the contactor and regenerator solutions.

J. F. Reed

Mills, C. A. REFLECTIVE RADIANT CONDITIONING CAN PROVIDE... MORE COMFORT AT LESS COST. *Refrigerating Eng.*, 63, 48-51 (1955) January.

Emphasis is placed on the role of radiant heat transfer in air conditioning for human comfort. The principles, materials and equipment for a Reflective Radiant Conditioning System are discussed. J. F. Reed

Williams, D., Jr. AIR CONDITIONER. U.S. 2,694,905 (1954) November 23.

An absorption refrigeration apparatus employing heat from an internal combustion machine for the generator is described. A conventional automobile engine application is described for air conditioning, a vehicle using the refrigerant fluid for cooling in the summer and heating in the winter. J. F. Reed

Heat Pumps

Ruff, A. W. (assigned to V. C. Patterson and Assoc.) HEAT PUMP WATER HEATER. U. S. 2,696,085 (1954) December 7.

An electrically-operated heat pump is used to furnish hot water. The motor-compressor unit is mounted in the storage tank. Heat is drawn from the kitchen chimney. J. F. Reed

Rygard, S. O. HEAT TRANSFER BETWEEN TWO MEDIA ACCORDING TO THE CARNOT PRINCIPLE. U. S. 2,698,524 (1955) January 4.

A method of heat transfer is claimed using a plurality of heat pumps each containing a fluid circulated in a closed circuit between an evaporator and a condenser at different pressures. The heat pumps all operate at different temperatures. J. F. Reed

Incinerators

Marble, G. E. DESIGN FOR SUCCESSFUL COMMERCIAL INCINERATION. Gas Age, 115, 19-22, 51, 52 (1955) January 27.

The installation and use of incinerators had greatly increased in the past few years for several reasons. The first of these is the economic consideration that it is often much cheaper to dispose of garbage at the source rather than to pay hauling charges to some distant point. Second, sanitation problems are greatly reduced when refuse is not permitted to accumulate over a considerable period of time. A third reason is that, with increased use of automatic heat, the old practice of using the heating plant as a garbage burner cannot be continued. This article points out the factors involved in designing successful incineration units, and gives a number of case histories. E. F. Searight

Refrigeration

Green, F. H. (assigned to The Garrett Corp.) REFRIGERATION AND VENTILATION DEVICE. U. S. 2,693,088 (1954) November 2.

A refrigeration system supplying cooled air under pressure is described with special application to a flying suit for an aircraft pilot. The system utilizes compressed air from an engine supercharger or compressor of a jet engine cooled by heat exchange with atmospheric air and air cooled by passage through an expansion turbine. J. F. Reed

Jones, F. M. (assigned to The U. S. Thermo Control Co.) METHOD AND MEANS FOR AIR CONDITIONING. U. S. 2,696,086 (1954) December 7.

An air conditioning system is described for a railway boxcar suitable for conditioning of perishable and frozen foods. The system is completely contained in the boxcar and uses an internal combustion engine for compression refrigeration. J. F. Reed

Masing, B. HEAT EXCHANGE UNIT OF AN ABSORPTION REFRIGERATING APPARATUS. U. S. 2,693,091 (1954) November 2.

This invention relates to absorption refrigeration apparatus of the inert gas, single pressure type. A heat exchanger is provided which also embodies a liquid seal for regulation of flow of gas to the evaporator. J. F. Reed

Weiss, H. L. COMBINATION REFRIGERATOR AND SPACE COOLER. U. S. 2,697,333 (1954) December 21.

This invention relates to a combination refrigerator and space cooler in a single unit equipped with a blower or fan for circulating the cooled air. J. F. Reed

Water Heating

Hamberg, I. H. AUTOMATISKA VARMVATTEN-APPARATER AV GENOMSTROEMNINGSTYP. (AUTOMATIC HOT WATER APPARATUS OF THE THROUGH-FLOW TYPE.) *Svenska Gasverksfoereningens Manadsblad* (Swedish) 22, 9-17 (1955) January.

The instantaneous gas water heaters are very popular in Sweden and there are at present more than 10.000 of that type installed in Stockholm. The design and the function of the instantaneous water heaters is described in detail as well as the influence of variations of gas and water pressure, when the heaters are in operation. Author's Abstract

Hastings, G. T. MODERN HOT WATER SUPPLY. *Gas Heat*, 6, 64, 68, 70 (1955) January.

The article is trying to impress upon salesmen the importance of selling a heater capable of handling, not only the average load, but also capable of handling automatic clothes and dish washers. J. G. Chalcraft

Johnson, C. W. (assigned to Johnson Gas Appliance Co.) STOCK WATER HEATER. U. S. 2,696,815 (1954) December 14.

The invention relates to a water heater adapted to retain water in a tank at a suitable temperature. This tank will be located in a pasture where it is convenient for cattle. The invention is operated by gas burners which are intended to be immersed in tanks. The object of the invention is to provide a heater with a immersed well heat exchanger that will remain dry, with free circulation of air provided throughout the depth of the well to re-evaporate and expel from the heater any condensate, so as not to extinguish the burner. J. G. Chalcraft

3. COMBUSTION AND INDUSTRIAL FURNACES

Aluminized Steel

NEW PROCESS FOR PROTECTING STEEL USES GAS EQUIPMENT IN HEATING. *Amer. Gas J.*, 182, 20 (1955) January.

A new process has been developed for aluminum coating of steel. An aluminum penetration in the steel of approximately 0.001 in is obtained. Gas-fired equipment is used to heat the cleaning and fluxing baths, and to melt the aluminum.

E. F. Searight

Commercial Hot Water

Reiter, F. M. HOT WATER FOR LARGE VOLUME NEEDS. PART VIII: PROBLEMS AND THEIR SOLUTIONS. *Ind. Gas*, 33, 8-10, 18, 19, 21 (1955) January.

The eighth and last in a series of articles that have covered all phases of hot water used in industrial and commercial plants. Some tables given are as follows: 1) Combustion efficiency of gas-fired equipment, assuming a flue-gas temperature of 300° F. Dewpoint temperature is added for condensation problems; 2) loss of heat up the stack for various flue-gas temperatures and analyses resulting from burning natural gas; 3) heat transferred through steel plate with various incrustations for various differences between the temperatures of the steel plate and the water of the hot water heater; 4) minimum sizes of vents and flues for gas appliances. (See *Gas Abs.* 11, 4) J. G. Chalcraft

Flame Research

Kaskan, W. E. and Noreen, A. E. HIGH-FREQUENCY OSCILLATIONS OF A FLAME HELD BY A BLUFF BODY. Amer. Soc. Mech. Eng. Paper No. 54-A-66 (1954) November-December.

Experimental data are presented on the occurrence of flame-sustained transverse oscillations in a 2- x 4-in. duct with a V-gutter flameholder. The flame-speed versus flow-velocity field of burner operation was divided into an oscillation region and a nonoscillation region. The boundary line between the two was approximately described by an equation of the form

$$S_u U^{1.6} = \text{a constant}$$

where S_u is the laminar flame speed and U is the flow velocity. The oscillation was characterized by the formation of vortices downstream of the flame-holder tips. These vortices distorted the flame front in such a way as to provide the driving force for the oscillation.

Authors' Abstract

Miao, Y. M., Price, T. W., and Potter, J. H. TRANSIENT GAS-FLAME TEMPERATURES IN A SPHERICAL BOMB. *Amer. Soc. Mech. Eng. Trans.*, 77, 89-96 (1955) January.

Temperatures of lean methane-oxygen flames in a spherical bomb were measured by a modification of the sodium line reversal method. The variation of the intensity of the D-lines as the sodium colored flame passed through the light beam from a standardized lamp, was read on an oscilloscope. Near the point of ignition, the observed temperatures were close to theoretical. The temperature drops as the flame nears the walls in spite of compression effects.

S. A. Weil

Wagner, P. and Dugger, G. L. FLAME PROPAGATION. V. STRUCTURAL INFLUENCES ON BURNING VELOCITY. COMPARISON OF MEASURED AND CALCULATED BURNING VELOCITY. *J. Amer. Chem. Soc.*, 77, 227-31 (1955) January 5.

Measurements were made using both the horizontal tube and the bunsen methods. In the bunsen method, values were calculated from the total area of the schlieren cone. Many of the fuels used were liquids at atmospheric temperature and pressure. These fuels were heated to temperatures sufficient to give vapor pressures in excess of the desired concentration of combustible. A correction equation was determined for extrapolating the results to a base initial temperature of 298°K. Burning velocities obtained by both experimental methods were treated on a single group, though values obtained by the bunsen method were, in general, 10% higher than values obtained by the tube method. Values presented are for those mixtures of fuel and air which give maximum burning velocities. The effect of chain length, degree of saturation and substitution were also investigated. Calculations were made by the method of Tanford and Pease, and are compared with the experimental values.

E. F. Searight

Galvanizing Fuel

Smith, A. Q. NESCO IMPROVES GALVANIZING BY SHIFT TO GAS. *Ind. Gas*, 33, 3, 4, 20, 21 (1954) December.

Kettles, formerly fired by coke, converted to natural gas, with excellent results from uniform temperature operation. Author's Abstract

Heat Treating

HOW J & L PRODUCES SEAMLESS TUBES. *Ind. Gas*, 33, 12-14, 24 (1955) January.

A new specialties department of Jones and Laughlin Steel Corp. have a new process which makes possible finishing of seamless oil country casing and tubing by quench and temper heat treatment, imparting to these products characteristics that formerly were attained through adjustments in the chemical composition of the steel. The new process will result in savings of many tons annually of strategic alloying metals, manganese, molybdenum and chromium formerly used in steels for high strength seamless pipe. J. G. Chalcraft

Oxy-Fuel Gas Burners

Moen, W. B. and Shepherd, T. L. FLAME-STABILIZED OXY-FUEL GAS BURNERS. Amer. Soc. Mech. Eng. Paper No. 54-A-193 (1954) November.

Various methods of stabilizing flames are discussed. The use of pilot flames were investigated experimentally and high pressure burner data are given for operation of oxygen-propane and oxygen-acetylene flame stabilized burners, and also for oxygen-acetylene unstabilized burners for comparison purposes.

E. F. Searight

Pottery Firing

Abram, J. C. AN INTRODUCTION TO CERAMIC ARTWARE MANUFACTURE. *Butane-Propane News*, 17, 50-54 (1955) January.

The operations encountered in artware production are described as are the types of drying and firing equipment employed. R. T. Ellington

FIRING DECORATIONS ON POTTERY WARE. *Ind. Gas* (British), 18, 117-18, 120 (1955) January; *Gas World*, 141, Suppl. 12-13 (1955) January 15.

A new batch-type kiln of low capital cost is described and illustrated. The kiln has a load volume of 70 cu ft with a maximum gas consumption 1,180 cu ft per hr. The kiln is radiant-heated with a maximum operating temperature of 800° C. J. G. Chalcraft

Poultry Farm Fuel

Hathaway, H. CHICKEN SELLER GOOD PICKING. *LP-Gas*, 15, 43 (1955) January.

An article describing the advantages in using LP-gas for poultry raisers, because of its constant load, winter and summer, giving even heat. The methods have also proven extremely economical. J. G. Chalcraft

Textile-Mill Fuel

HOW TEXTILE OPERATIONS ARE BEING IMPROVED. *Ind. Gas*, 33, 12, 14, 16-19 (1954) December.

Some case histories of more important heat applications in processing of woven textiles: Singeing; dry boxes or ovens; tenter frame dryers; nylon setting; can drying; calender rolls. Author's Abstract

4. GASIFICATION AND CARBONIZATION

Carbon Purification

Hartwick, E. F., Miners, K. A., and Phillips, N. W. (assigned to Aluminum Lab. Ltd.) PROCEDURE FOR TREATING SOLID MATERIAL WITH GAS AT HIGH TEMPERATURE. U. S. 2,698,777 (1955) January 4.

Iron and other metallic contaminants are removed from carbonaceous materials (coke and anthracite) by chlorination at high temperature (1400° C.) in a refractory lined, electrically heated tower which includes a pretreatment chamber (volatiles removal) and a chlorination zone. Gas flow between zones is prevented, by sliding plates, which permit intermittent downward flow of solids. O. P. Brysch

Coal Burning Turbine

Yellott, J. I. (assigned to Bituminous Coal Research, Inc.) OPEN CYCLE COAL BURNING GAS TURBINE SYSTEM WITH REGENERATOR. U. S. 2,699,039 (1955) January 11.

This patent discloses the use of an auxiliary air

compressor, plus a hot turbine-exhaust stream bled from the regenerator, to dry and transport pulverized coal in a coal-burning gas turbine installation. P. R. Trumpler

Dust Removal

Burnside, H. E., and Brown, J. W. (assigned to Standard Oil Development Co.) CYCLONE SEPARATOR FOR SEPARATING SOLID PARTICLES FROM GASIFORM MIXTURES. U. S. 2,698,672 (1955) January 4.

This cyclone type separator for the separation of hot finely divided solids from a gaseous reaction mixture is particularly adapted for high temperature petroleum oil cracking operations. The cyclone casing is conical-helical in shape which results in effective solid separation for a relatively short residence time of about 0.25 seconds. E. J. Pyrcioch

Gasification Kinetics

Batchelder, H. R. and Busche, R. M. KINETICS OF COAL GASIFICATION. *Ind. Eng. Chem.*, 46, 2501-2508 (1954) December.

Theoretical computations of reaction rates and carbon conversions in powdered coal gasification with oxygen and steam are presented in the form of graphs relating operating results with inlet conditions and residence time. Effective residence time is estimated from auxiliary plots against coal input rate and oxygen-coal ratio for various steam-coal ratios. Although examples of the application of the theoretical results in estimating gasifier design and operating costs are included, such results must be used with reservation, pending satisfactory verification of the theory by experimental data. C. G. von Fredersdorff

Hydrogen for Ammonia

Burt, R. B. CONVERSION FROM COKE TO NATURAL GAS AS RAW MATERIAL IN AMMONIA PRODUCTION. *Ind. Eng. Chem.*, 46, 2479-85 (1954) December.

The Tennessee Valley Authority, by converting its ammonium nitrate plant's source of hydrogen from the coke semi-water gas process, built in 1942, to a reformed natural gas process in 1951, increased the capacity from 160 to 250 tons ammonia per day. Both hydrogen producing systems are described, with flowsheets and operating data. Careful plant tests of the original water gas conversion equipment showed that the CO converters, CO_2 scrubbers and compressors were adequate for handling the purification of the increased gas throughput with the natural gas process. New catalytic reformers, sulfur removal units, and additional waste-heat boilers were designed on the basis of the tests, and added to the two production trains for assured self-sufficiency in process heat and steam. Changeover to natural gas was made on one train at a time, with only one day interruption of ammonia synthesis, and the plant has operated at 252 tons ammonia per day at reduced costs for the past 3 years. O. P. Brysch

Oil Gas

Voelker, J. G. (assigned to Allied Chem. and Dye Corp.) PROCESS FOR PRODUCING A NATURAL GAS SUBSTITUTE FROM GAS OIL. U. S. 2,700,601. PROCESS FOR PRODUCING A NATURAL GAS SUBSTITUTE FROM HYDROCARBON OIL. U. S. 2,700,602 (1955) January 25.

Patents 2,700,601 and 2,700,602 cover a cyclic oil gas process for producing substitute natural gas in converted carbureted water gas machinery. The process features atmospheric pressure operation, forward make and blast cycles and checkerless generators. Normal yields are claimed and emulsion-free tar is also claimed. No tar data is presented. W. G. Bair

Pressure Gasification

Hebden, D., Edge, R. F. and Foley, K. W. GASIFICATION UNDER PRESSURE. *Gas J.* (British), 280, 793-96 (1954) December 22.

An investigation of the effects of operating variables in Lurgi pressure gasification demonstrated that, apart from caking characteristics of the fuel, the important properties of the fuel that influence its gasification are volatile matter content, reactivity to steam and fusion temperature of the ash. Difficulties due to caking can be overcome to some extent by adding a mechanical stirring device in the gasifier. The volatile matter content primarily determines the quantity of methane obtained by thermal decomposition and by hydrogenation under a

given pressure. Increasing the hydrogenation contact time by increasing the pressure or the fuel-bed depth permits significant increases in methane content. It is suggested that the methane content may be further increased by a) recycling product gases, which have been freed of carbon dioxide and undecomposed steam, back to the hydrogenation zone; b) allowing the hydrogenation to continue in a separate reactor or c) thermally cracking liquid hydrocarbons into the Lurgi gas. In a non-clinkering operation, ash fusion temperature of the fuel determines the minimum steam-oxygen ratio. For a low ash fusion coal, the steam-oxygen ratio may be as high as 10.0 volumes/volume. This causes a decrease in thermal efficiency by virtue of the large proportion, 60%-70% undercomposed steam leaving with the product gases. In future studies a slagging operation will be attempted at reduced steam-oxygen ratios. C. G. von Fredersdorff

Kalbach, J. C. (assigned to Hydrocarbon Research Inc.) GASIFICATION OF SOLID CARBONACEOUS MATERIALS. U. S. 2,700,599 (1955) January 25.

The patent describes an improved fluidized process for gasifying coke, coals and oil shale in which ash is discarded from the fluidized mass undergoing gasification as a stream of solids having a higher ash content than that of the fluidized mass. The feed charged to the gasification reactor consists of particles of 0.25-0.1 inch in diameter and is a mixture of carbonaceous material and its char in the ratio of 1:5 by weight. Temperatures and pressures employed in the reaction zone range from 1600°-2600° F. and 200-500 pounds per square inch gauge respectively. K. C. Channabasappa

Synthesis Gas

Montgomery, C. W., and Weinberger, E. B. (assigned to Gulf Research and Devel. Co.) SYNTHESIS GAS MANUFACTURE. U. S. 2,699,383 (1955) January 11.

The author presents equilibrium data on carbon formation in synthesis gas production, via the reactions $CH_4 \rightarrow 2H_2+C$ and $2CO \rightarrow CO_2+C$. The zone of carbon formation is defined for fixed $O2/CH_4$ ratios and various temperatures and pressures. In the generation of synthesis gas by partial oxidation of methane under pressure, and in its subsequent cooling and pressure reduction, it is desirable to maintain pressure-temperatures relationships outside of the area of predicted carbon deposition. C. G. von Fredersdorff

Moses, D. V. and Thayer, V. R. (assigned to E. I. du Pont de Nemours and Co.) PREPARATION OF SYNTHESIS GASES. U. S. 2,697,696 (1954) December 21.

This invention refers to the production of ammonia synthesis gas by combining the water-gas produced from conventional cyclic gasifiers with that produced by modified continuous generators employing oxygen-enriched air up to 90% oxygen content. C. G. von Fredersdorff

Sulfur Recovery

SULFUR AND H2SO4 PRODUCTION IN ENGLAND. *Oil Gas J.*, 53, 87-89 (1955) January 10.

Recent installations at United Kingdom oil refineries for recovery of elemental sulfur from refinery gases and of sulfuric acid from acid sludge are described. D. M. Mason

Underground Gasification

Pearce, F. G., and Latta, J. E. (assigned to Stanolind Oil and Gas Co.) METHOD FOR GASIFICATION OF SUBTERRANEAN CARBONACEOUS DEPOSITS. U. S. 2,695,163 (1954) November 23.

This patent presents a scheme for underground gasification which involves the drilling of a number of injection wells and withdrawal wells in a special circular pattern. After ignition, oxygen is injected into the burning zone and gas is withdrawn until combined carbon monoxide and hydrogen content falls below about 70 percent. It is claimed that steam-oxygen mixtures (ratios from 1.5 to 3.0) may also be used for injection. E. B. Shultz

The following article, the abstract for which appears on the page indicated, is called to your attention:

Leffer, F. A. CONTACTING SOLID PARTICLES WITH THREE FLUID STREAMS. p. 74.

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Alabama Market

Nickel, W. GAS COMES TO SOUTHEAST ALABAMA. *Gas Age*, 114, 24-27,46, 48 (1954) December 30.

Fourteen communities in Alabama have combined to bring natural gas into the area. The venture will represent an estimated $19,500,000 investment in line and facilities and will serve a population of 105,000, with a market of 30,000 plus customers expected within a few years. New distribution systems will be constructed in 21 communities by the company. Gas mains and services will be laid to serve all customers initially applying for gas at company expense, after operations have begun customers will stand the expense of tie-in. It is hoped the system will be ready for the 1955-56 heating load. B. E. Eakin

Compressors

GAS SELECTED BIBLIOGRAPHIES. 5. COMPRESSORS AND COMPRESSOR STATIONS. *Gas*, 31, 63-64 (1955) February.

A selected listing of articles on compressors and compressor stations appearing in *Gas* over the past 30 years. R. F. Bukacek

Condensate Recovery

Resen, F. L. RENWAR'S NEW ISLAND PROCESSING PLANT. *Oil Gas J.*, 53, 104-07 (1955) January 24.

The Mustang Island liquid recovery plant is located on the island separating Corpus Christi Bay from the Gulf of Mexico. Designed to handle about 50 MMCFD it is presently processing about 30 MMCFD of wet gas from offshore wells. Flowing well-head pressures are from 2300-2800 psi, and gathering lines operating with two-phase flow at well-head pressure, deliver the gas to the plant at 1800 or 2200 psi header pressure. Individual well streams are metered, and a test separator and tank is provided for determining allocation of incoming streams according to content of dry gas, flash gas, distillate, and water. The plant uses salt water for the spray cooling towers required by the small compressor installation for handling casing head gas from low-pressure wells. The entire installation is constructed on a built-up fill to protect it from the sea, and all metal was provided with a Dimetco coating to prevent corrosion. B. E. Eakin

Dehydration

Reid, L. S. METHOD OF DEHYDRATING NATURAL GAS AND RECOVERY OF LIQUEFIABLE HYDROCARBONS THEREFROM AT HIGH PRESSURES. U. S. 2,690,-814 (1954) October 5.

This invention relates to an apparatus and method for dehydrating well-head gas and for recovering the heavier hydrocarbon fraction with the same operation. The system uses a dilute solution of glycol to prevent hydrate formation, and provides for the recovery of the glycol for recycling. B. E. Eakin

Distribution Computations

Ebdon, J. F. DIGITAL COMPUTERS—THEIR APPLICATION TO THE GAS INDUSTRY'S ENGINEERING PROBLEMS. *Gas*, 31, 109-115, 120 (1955) January.

A general review of computers available for use by the gas industry. The digital computer is discussed and its various applications to problems confronted by the gas industry are outlined. A table is included listing some of the uses to which digital computers have so far been put, and the experience of a transmission company and a distribution company are presented. B. E. Eakin

Sickafoose, R. D. SPEEDS DISTRIBUTION NETWORK ANALYSIS. *Amer. Gas Assoc. Monthly*, 36, 29-30 (1954) December.

By utilizing the I.B.M. punched card equipment available in the accounting department, the engineering staff of the Peoples Gas Light and Coke Company in Chicago have greatly reduced the time and effort involved in distribution network analysis. Repeated calculations of Hardy Cross method of balancing heads applied to the solution of gas distribution network are performed more quickly and precisely by this digital computer method. The largest problem solved to date was a network of 400 loops, 1000

mains, and six sources of supply. Seventy-three man hours were required to prepare, key-punch, and verify the data before computation, with a total of 2,262 cards in the deck. The system was considered balanced after 8 iterations, taking about 5 hours each. A paper describing in detail the programming of the Hardy Cross method for IBM machines will be presented at the April, 1955, AGA Distribution, Motor Vehicles, and Corrosion Conference. B. E. Eakin

Drilling

Sage, J. F. WATER ANALYSES HELP IDENTIFY FORMATIONS. *World Oil*, 140, 75-78, 80 (1955) January.

The analysis of water encountered in drilling is a useful guide to identification of formations. The mineral analysis of various oil field waters indicate a decided pattern repeating itself over rather extensive areas. By plotting the mineral content on a standard graph, representing the more indicative components, comparison of the water with recorded known formation helps in identification. B. E. Eakin

Fuller, L. S. and Lockett, D. E. HOW AIR AND GAS DRILLING AIDED WILDCAT OPERATIONS. *World Oil*, 140, 110-12, 114 (1955) January.

El Paso Natural Gas Company has obtained excellent results drilling in the Colorado area using air as a drilling fluid. A mobile compressor unit and an engineering service have proven their value in three recent wildcat wells. Cuttings obtained from air circulation can be used by the geologist for logging purposes. This technique is especially suitable where hard, dry formations are penetrated. B. E. Eakin

Magner, H. J. LOST CIRCULATION AND COMPLETION PROBLEMS EASED. *World Oil*, 140, 116, 118, 120 (1955) January.

The use of air drilling in the Appalachian Basin has greatly reduced the cost of wells drilled by rotary rigs. The problems of lost circulation and formation contamination by muds have been eliminated, while maintaining a good penetration rate. Sufficient air volume must be maintained to blow all water entering uncased bore to the surface, along with the drill cuttings. A discussion of drilling into a gas pay with air is presented. B. E. Eakin

Equipment Handling

Ebdon, J. F. WAREHOUSE DESIGN. *Gas* 30, 33-38 (1954) December.

In this article the complexities of warehousing for the gas industry are discussed. Optimum designs are pointed out and many factors to be avoided are detailed. Materials handling equipment is treated in relation to efficient lay-out. Location for convenient operation is stressed. This is Part III of a series of four parts concerning materials handling.

Publishers' Abstract

Resen, F. L. STREAMLINE PLANT MAINTENANCE. *Oil Gas J.*, 53, 83-86 (1955) January 17.

The article describes a card index system for all plant equipment. The card lists the history and past maintenance of the unit. Records are periodically checked and routine work ordered as necessary. W. G. Bair

Gas Line Flow-Storage

Nisle, R. G. and Poettmann, F. H. CALCULATION OF THE FLOW AND STORAGE OF NATURAL GAS IN PIPE. *Petroleum Eng.*, 27, D14, 16, 18, 20-22 (1955) January.

A highly mathematical treatment is presented of the design calculation procedures for high operating pressures utilized in gas transmission. The deviation from ideal behavior must be considered and this article, the first in a series of three, illustrates how to solve storage and transmission problems. Tables and charts for use with the test will be published in subsequent issues. The derivations for the equations used are presented in appendices. B. E. Eakin

Industry Developments

NEW TECHNICAL DEVELOPMENTS OF 1954. *Pipe Line Ind.*, 2, 54-57, 60 (1955) January.

Presented are eight ideas which were proven by use during the past year. These include: 1) the largest diesel engine in pipe line service is operating in a remotely controlled pumping station at Vicksburg, Mich. 2) Installation of a balanced pressure control valve, using bottled nitrogen as reference pressure, achieves control of 4 psi in 1200 psi. 3) The stream blending of products to meet a given specification.

Control is by mechanical shaft computers driven by positive displacement meters. 4) A large-capacity meter prover using a "measured mile" of line and timing the passage of a scraper through this section. 5) Installation of a semi-automatic main line compressor station. 6) The proof of the acoustical pulsation dampener at compressor station discharge. 7) Detection of batch cut points by a capacitance recorder, and 8) the shipping of natural gas by barge at -250° F. from New Orleans to Chicago. The first barge is under construction.

B. E. Eakin

Liquid Recovery

Kalish, P. P. OPTIMUM CONDITIONS FOR MULTI-STAGE SEPARATION. *World Oil*, 140, 194, 196, 198, 200, 202 (1955) January.

A new apparatus designed by the author provides a laboratory instrument for determining the best operating pressures for any number of stages of separation utilizing only a small volume of a sample for each multi-stage test. The apparatus is of considerably increased accuracy over presently utilized equipment. The results of such investigations are higher liquid recoveries in field operation. Equipment, experimental procedures, and methods of presentation of laboratory data, are covered. B. E. Eakin

LP-Gas Underground

Abel, C. UNDERGROUND STORAGE—OUR INSURANCE AGAINST COLD CUSTOMERS. *Butane-Propane News*, 17, 64, 66, 68, 70, 74 (1955) January.

A discussion of the seasonal demand for LP-gas is followed by a description of types of underground storage utilized and a statewise summary of storage volumes. Some producers are using a price differential of 2¢/gal to cover storage costs. R. T. Ellington

Main Extensions

Lancaster, D. E. WHAT CONSTITUTES A SOUND MAIN EXTENSION POLICY? *Gas*, 31, 51-56 (1955) January.

With the constant widening of gas systems into new, scattered suburban developments, main extension policies that once were adequate may be completely unsatisfactory under today's conditions. In a broad study of utility policies, the author found basic divergences of opinion and practice, as well as alternative plans that appear to him to be sound. Suggested formulae for determining the type and size of mains to be used are explained and analyzed.

Publishers' Abstract

Meter Problems

Bachmann, G. K. ECONOMICS OF A PLANNED METER RETIREMENT PROGRAM. *Am. Gas J.*, 182, 16, 17, 24 (1955) January; *Gas Age* 115, 23-5, 66-8 (1955) February 10.

Prizewinning essay in the Rockwell contest is presented. The four principal economic considerations involved in a meter retirement program are presented and discussed in the light of the author's background and experience. Assuming a meter change period of 7 years, the optimum life of meters seems to be about 21 years, depending on the cost of rediaphragming.

G. G. Wilson

Ebdon, J. F. WHAT'S THE PREFERRED BASIS FOR METER CHANGE-OUTS? *Gas*, 31, 68-73 (1955) January.

Results of a survey of top metermen in the nation as to whether the mileage change-out or the periodic change-out is the better system for replacing meters. Advantages and disadvantages of both systems are discussed.

Publishers' Abstract

TROLLEY-CONVEYOR SYSTEM REDUCES METER REPAIR COSTS. *Gas*, 31, 55-56 (1955) February.

How an efficient overhead trolley-conveyor system replaced conventional methods for handling domestic gas meters as they are moved from station to station in a large meter repair shop is described in this article. The problem involved in handling the diverse sizes and models of meter prior to the installation of the advanced materials handling equipment is detailed. The paper is freely illustrated to visually demonstrate the installation of the conveyor. The story follows the path of meters through the repair shop. Publishers' Abstract

Nitrogen Removal

Twomey, L. S. MANIPULATION OF NITROGEN-CONTAMINATED NATURAL GASES. U. S. 2,696,088 (1954) December 7.

A method is presented for removing nitrogen

from natural gas by total liquefaction of the gas and fractionation in a distillation column. The product liquid methane is used to provide a portion of the refrigeration required.

B. E. Eakin

Off-Peak Load

Ebdon, F. J. BUILDING AN OFF-PEAK AND FRINGE LOAD. *Gas*, 31, 60-68 (1955) January.

With the greater availability of natural gas in the New York area, the problems associated with the differential between the peak and the off-peak loads are increased. To counteract this, Brooklyn Union Gas Co. has instituted a program to expand market demands in residential, commercial, and industrial heating.

Publishers' Abstract

Piping Renewal

Bissell, W. E. REPAIR COUPLING WITH TEMPORARY AND PERMANENT SEALS. U. S. 2,699,344 (1955) January 11.

This invention relates to a device comprising of a quickly attachable repair coupling which can be employed for repairing breaks in metallic sections of pipe lines. S. Volchko

Saurwein, G. K. RENEWING UNDERGROUND PIPING. *Heating, Piping and Air Cond.*, 27, 173-75 (1955) January.

Old underground piping systems are increasingly requiring replacement because of corrosion or failure. The advantages of renewing with copper tubing inserted into the old line include 1) 50 percent or greater savings in cost, 2) savings in manpower requirement, 3) minimum public disturbance, 4) long useful life of the copper, and 5) capacity of the copper line equal or greater than the line it is inserted into. The use of copper tube replacements is spreading from the gas industry to the district heating industry and is applicable to some areas of industrial piping. Details of one method of installation are given. B. E. Eakin

Reservoir Engineering

Dyes, A. B. PRODUCTION OF WATER-DRIVEN RESERVOIRS BELOW THEIR BUBBLE POINT. Amer. Inst. Min. Eng. Petrol. Branch Paper 417-G; Oct. 17-20 (1954).

The establishment of a free gas saturation in a water-driven reservoir can be established by maintaining a rapid enough production rate to reduce reservoir pressure below bubble-point. The benefit of this technique on displacement efficiency is illustrated by experimental data. The existence of an optimum displacement pressure is illustrated, with a pressure several hundred psi below the bubble point resulting in recovery of 7 to 12 per cent more oil than displacement at the bubble point. This increase is worthy of consideration in establishing the maximum efficient production rate for many water-driven fields. B. E. Eakin

Seismograph Exploration

Olson, R. W. HIGH RESOLUTION REFLECTION SEISMOGRAPH. *Oil Gas J.*, 53, 84-86 (1955) January 10.

The High Resolution system is based on the concept that the lower limit to the size of an object which may be "seen" by various physical systems is a function of the frequency of the radiation with which the object is "illuminated". The design may be used for the detailed coverage of large features at medium depth, for detecting small features, and for geological engineering work such as dam foundations. The system uses the higher frequencies generated by the explosion. B. E. Eakin

Survey on Exploration

Clark, W. W. WILL GAS COMPANIES INTENSIFY EXPLORATION ACTIVITIES? *Gas* 31, 122-124 (January 1955).

Some leading transmission companies believe that the fair field value formula together with the Philips decision would tend to encourage exploration and development programs; others hold opposite ideas. The author reports on an exclusive survey among the leading gas transmission companies that produce a share of the gas they transmit. Publishers' Abstract

Tape Wrappings

Parker, M. E. POLYETHYLENE TAPE FOR PIPE COATING. *Petroleum Eng.*, 27, D28-30 (1955) January; *Pipe Line News*, 26, 65-70 (1954) November.

The use of polyethylene tape for coating pipelines provides a new basis for design of cathodic protection systems. Latest advance in tape wrapping is the use of power driven equipment.

The use of tape for wrapping short replacement sections has been followed for several years. The new equipment will permit lines to be designed for this protective coating application method. (see *Gas Abst* 11, 26).

B. E. Eakin

Well Flow

Smith, R. V., Williams, R. H. and Dewees, E. J. MEASUREMENT OF RESISTANCE TO FLOW OF FLUIDS IN NATURAL GAS WELLS. *J. Petroleum Techn.*, 6, 41-48 (1954) November.

In an effort to establish a clear and concise terminology, the authors have made the following definition of terms: "f" is designated as "resistance coefficient", and $\sqrt{1/f}$ as "transmission factor". Transmission factors data were collected on 14 gas wells with 1¼, 2, 2½ and 3 in. tubing and 5½ and 7½ in, casing. The calculated results were found to follow the Nikuradse equation for turbulent flow in "rough" pipes with an average absolute roughness of 0.000,65 in. This is believed to represent an average roughness for uncorroded well strings representative of those in use today. By use of this factor a more accurate calculation of subsurface pressures in gas wells is possible.

B. E. Eakin

6. PETROLEUM; SYNTHETIC LIQUID FUELS

California Oil

Moody, G. B. CALIFORNIA OIL: IT'S GEOLOGICAL RELATION AND PRODUCTIVE HISTORY. *Petroleum Eng.*, 26, B25-32 (1954) December.

California can be divided into 5 main productive provinces. Geologically speaking, the state is young, and recent earth movements have influenced structures. Production is from many zones, with the productive characteristics being influenced by geological age. Faulting has been important in trap formation, but future discoveries will probably be made in overthrust areas. The search for oil in California began early, but trained geologists were slow to appear. Discoveries show a cyclic pattern following roughly the introduction of the different seismic techniques. Production is presently exceeding discovery rate, with the big fields constituting a major portion of the proved reserves. The wildcat success factor is low, but acre recovery is very high.

B. E. Eakin

CALIFORNIA TIDELANDS—WHAT IS THEIR FUTURE? *Petroleum Eng.*, 26, B57, 58, 60, 62 (1954) December.

The offshore oil reservoirs of California may yield more than two billion barrels of oil. According to geologic data there should be extensive oil reservoirs under the tidelands. Oceanic seismic crews are presently prospecting the more promising areas.

B. E. Eakin

Catalyst Preparation

Farrow, H. L. (assigned to Phillips Petroleum Co.) METHOD OF PREPARATION OF SUPPORTED NICKEL, COBALT, OR COPPER CATALYSTS. U.S. 2,696,475 (1954) December 7.

A highly active finely divided nickel, cobalt and/or copper impregnated catalyst is produced by forming a metal carbonate, or a carrier in situ from a complex metal ammonium salt with which the carrier has been impregnated, by contacting the carrier with carbon dioxide.

H. A. Dirksen

Probst, R. E. (assigned to Standard Oil Co.) HYDROGENATION OF CARBON MONOXIDE UTILIZING AN ALLOY CATALYST. U. S. 2,698,862 (1955) January 4.

An alloy of manganese, copper, aluminum is used as a catalyst in the preparation of liquid hydrocarbon from hydrogen and carbon monoxide. The alloy consists of 5-30 atomic percent manganese, 15-45 atomic percent aluminum and 40-70 atomic percent copper. The advantages claimed by this improved catalyst are resistance to spalling, resistance to particle size reduction, and prolonged activity without regeneration.

H. A. Dirksen

Desulfurization

Engel, W. F. and Hoog, H. (assigned to Shell Development Co.) TREATMENT OF HYDROCARBON OILS. U. S. 2,697,683 (1954) December 21.

An improved cobalt-molybdenum catalyst with which desulfurization of hydrocarbon oils may be carried out more efficiently, more selectively, and more economically is disclosed. The catalyst

is an impregnated type molybdenum oxide catalyst promoted with a small amount of cobalt and preferably also with a small amount of potassium. When the catalyst is prepared by impregnating a suitable carrier with the molybdenum and promoter, it is found that a higher activity is obtained than when incorporating the same amount of metals by precipitation.

D. M. Mason

Porter, F. W. (assigned to Anglo-Iranian Oil Co., Ltd.) CATALYTIC DESULFURIZATION OF PETROLEUM HYDROCARBONS. U.S. 2,697,682 (1954) December 21.

According to the invention, the desulfurisation of a petroleum distillate is effected by passing the distillate over a catalyst effective for the dehydrogenation of naphthenes to aromatics and the hydrogenation of organic sulphur compounds and which is not poisoned as a catalyst by the presence of sulphur compounds, under conditions of temperature and pressure such that the distillate is maintained substantially in the liquid phase, and organic sulphur compounds present in the distillate are converted into hydrogen sulphide by means of hydrogen produced by dehydrogenation of naphthenes present in the distillate. Under such conditions it is found that addition of hydrogen or recycling of hydrogen to the reaction zone is unnecessary. The preferred catalyst consists of a mixture of the oxides of cobalt and molybdenum, or a chemical compound of cobalt, molybdenum and oxygen, or a mixture of one or both of said oxides with said compound, either alone or incorporated with a support.

D. M. Mason

Ellenburger Exploration

Morrisey, N. S. ELLENBURGER: IT'S A MAGIC WORD IN WEST TEXAS. *Oil Gas J.*, 53, 78-84 (1955) January 3.

Exploration efforts in West Texas are geared to locating new reserves in the very prolific Ellenberger formation. Pay thickness has ranged from less than 100 to more than 1000 feet at depths of 12,000 to 14,000 feet. Many of the wells drilled to date fall in the million-barrel class, and several of the fields are already approaching 100 million barrels recovery. Most wells are completed flowing, with potentials as high as 2000 barrels per day. A rough rule of thumb used in calculating reserves in the Ellenberger is 75-100 barrels per acre per foot of gross pay. Subsurface geology and seismic work are proving to be the best methods for finding these rich producing areas. This 10-page article presents the geology, production, and facts and figures about the Ellenberger.

B. E. Eakin

European Oil

Tannhauser, J. U. OIL SUPPLY AND DEMAND IN EUROPE. *Oil Gas J.*, 53, 186, 189-192 (1954) December 27.

The consumption of petroleum products has more than doubled from 1949 to 1953, and is expected to increase another 7 percent in 1954. However, refinery capacity is increasing at an even faster rate; by January 1, 1955, Europe will have a crude throughput capacity of 2,400,000 bbl. daily. Domestic consumption is estimated at 1,600,000 bbl. per day, which indicates a considerable over-supply. Whether the supply and consumption approach each other will depend on fuel policy, government controls, and consumer demands. Europeans can use the supply, if they are permitted. Europe is beginning to develop a home supply of oil. Germany and France have each made progress in this direction in the last year. The availability of Middle Eastern crude has tended to slow domestic supply development.

B. E. Eakin

Flooding Economics

Brundred, L. L., and Brundred, L. L., Jr. ECONOMICS OF WATER FLOODING. *J. Petroleum Tech.*, 7, 12-20 (1955) January.

The economics of water flooding have not lent themselves to as precisely accurate interpretations as the engineering phase has presently achieved. The economic fundamentals can be stated in the form of a simple formula: Expected gross revenue less the summation of computed acquisition costs, development costs, and operating costs (over the life of the flood) equals the estimated gross profit. Approximately 7 out of 10 waterflood attempts are failures; and most failures can be attributed to improper engineering, lack of experience, or shortage of working capital. The returns from a water flood are very slow, and payout is over a long period

of time. The conclusion is that a successful water flood is dependend on: adequate engineering, former experience, and sound economics.
B. E. Eakin

Craig, F. F., Jr., Geffen, T. M., Morse, R. A. OIL RECOVERY PERFORMANCE OF PATTERN GAS OR WATER INJECTION OPERATIONS FROM MODEL TESTS. T. P. 3981. *J. Petroleum Tech.*, 7, 7-14 (1955) January.

A series of oil recovery performance tests of water and gas floods for a five-set injection pattern were conducted in the laboratory on consolidated sandstone models, using a modification of the x-ray shadowgraph method for observing fluid movement. A method of applying the mobility ratio concept to water or gas flooding was developed, and the areal sweep efficiency and breakthrough for dispersed gas drives was determined to be much higher than previously indicated, lying in the range of 50 to 100%. A method for predicting water-oil ratio performance for five-set patterns is presented, and has been experimentally verified for conditions of no free gas and gas saturation normally encountered following depletion production. Gas injection prediction of performance is also given.
B. E. Eakin

7. ANALYTICAL METHODS AND TESTS

Distillation Curves

Oehler, H. A. and Van Winkle, M. COMPARISON OF TBP AND ENGLER TYPE DISTILLATIONS AT SUBATMOSPHERIC PRESSURES. *Petroleum Eng.*, 27, C10-12 (1955) January.

An experimental investigation of the relationship between true boiling point and Engler type analytical distillation curves of a number of petroleum oil stocks was conducted. TBP distillations were conducted at 50 mm Hg pressure in an Oldershaw, 15 perforated plate column, and Engler type distillations on the same stocks were determined at 760, 400, 200, 100, and 50 mm Hg. A correlation of the 50 per cent boiling temperature of the 50 mm Hg TBP distillation with the 50 per cent boiling temperatures of the Engler type distillations was derived and is reported here. It was found that the slopes of the Engler type distillation curves did not vary with pressure (within the estimated limits of accuracy of the tests.) The correlation is useful in transposing from analytical vacuum Engler distillation data to true boiling point distillation or from TBP data to vacuum Engler Data.
Authors' Abstract

Gas Analysis

Thoenes, H. W. DIE KOHLENDIOXYD-ABSORPTION VON SPERRFLUESSIGKEITEN ALS FEHLERQUELLE BEI DER GASANALYSE. (CARBON DIOXIDE ABSORPTION BY THE SEALING LIQUID AS A SOURCE OF ERROR IN GAS ANALYSIS. *Brennstoff-Chemie* (German), 35, 374-77 (1954) December 15.

Errors in gas analysis due to absorption of CO_2 by the liquid medium used to displace the sample from the sample container were investigated. Displacement media studied were water, 0.1N H_2SO_4, 0.1N acetic acid; NaCl, Na_2SO_4 glycerine-H_2SO_4-H_2O solution; aniline, and mercury.
D. M. Mason

Mercaptan Method

Grimes, M. D., Puckett, J. E., Newby, B. J., and Heinrich, B. J. AMPEROMETRIC METHOD FOR MERCAPTAN SULFUR IN HYDROCARBONS. *Anal. Chem.*, 27, 152-54 (1955) January.

The amperometric titration of total mercaptan sulfur with silver nitrate has been applied to synthetic blends of mercaptans in hydrocarbons. The average deviation from the true value was 1 p.p.m. for liquid hydrocarbons containing mercaptan sulfur in the range of 0 to 100 p.p.m., and 3 p.p. for gaseous hydrocarbons containing mercaptan sulfur in the range of 0 to 400 p.p.m. Organic sulfides, disulfides, thiophene, and tetraethyllead do not interfere. Free sulfur in amounts of less than 0.001% does not interfere. The apparatus is simple, compact, and portable. The amperometric titration can be completed in less than 10 minutes, and is especially suitable for use in routine determinations of total mercaptan sulfur in hydrocarbons.
Authors' Abstract

Microanalytic Methods

Seely, B. K. DETECTION OF CERTAIN IONS IN 10^{-10}—to 10^{-15}-GRAM PARTICLES. *Anal. Chem.*, 27, 93-95 (1955) January.

Particles floating and/or settling in the air

containing cobalt, copper, ferrous and ferric, nickel, potassium, sodium, carbonates, and iodides are caught by impact on a gelatin-glycerol medium, 0.3 mm thick, spread on microscope slides. Reagents can be added in or to the medium, or a film applied after collection and reagents allowed to seep through the film. Color, color halos, and diffusion rates of halo forming are used for qualitative identification and counted under microscopic magnification. Limits dilution of 10^{-15} gm is possible for some elements. R. R. Amrine

Shale Oil Fractions

Karr, C., Jr., Weatherford, W. D., Jr., Kendrick, T. R., and Capell, R. G. CHROMATOGRAPHIC FRACTIONATION OF TOTAL CRUDE SHALE OIL. *Anal. Chem.*, **26**, 1841-1849 (1954) November.

Elution chromatography on activated alumina or bauxite was employed to fractionate crude shale oil. A low-sulfur, nitrogen-free, colorless hydrocarbon mixture was recovered in 40 to 45 wt. percent yield. The residue was a brown-black semisolid rich in nitrogen and sulfur compounds, and asphaltic in nature. The procedure is suggested as a convenient basis for developing crude shale oil assay or refining methods. E. B. Shultz

Trace Metals

Gent, L. L., Miller, C. P., and Pomatti, R. C. SPECTROGRAPHIC ANALYSIS OF PETROLEUM PRODUCTS AND RELATED MATERIALS. *Anal. Chem.*, 27, 15-17 (1955) January.

A new method for the preparation of samples in the spectrographic determination of relatively large quantities of metals and phosphorus in various materials is described. New and used lubicating oils, additive concentrates, greases, sludges, and deposits can be analyzed using this technique. The average error is about ±10% of the element present. R. R. Amrine

Gillette, J. M., Boyd, B. R., and Shurkus, A. A. SPECTROCHEMICAL DETERMINATION OF METALLIC ELEMENTS IN NONMETALLIC SAMPLES. *Appl. Spectroscopy*, 8, 162-168 (1954) November.

A general discussion of some methods of analysis for metals in nonconductive mediums. The vertical rotating electrode for oil analysis uses a water-cooled boat and axle for the electrode. Briquetts of cement samples with both the internal standard and graphite are used as a rotrode. Better results with cement may be had by furnace fusion followed by a point to plane discharge. Nickel ores and other metal slags may be analysed by the furnace fusion technique, but a newer method is a fusion of the material by high frequency furnace in the analytical gap, then the analytical discharge while the sample is still in the molten stage. X-ray quantometer techniques have been developed for steels and brasses and for tetraethyl lead and ethylene dibromide in gasoline. Furnace fusion techniques are required for slags, ores, and minerals but not for catalyst analysis. R. R. Amrine

Sherwood, R. M. and Chapman, F. W., Jr. NEW TECHNIQUES FOR ANALYZING MIXTURES OF TRACE METALS. *Anal. Chem.*, 27, 88-93 (1955) January.

The accurate determination of trace amounts of metals in mixtures is difficult owing to interferences. Many of the existing spectrophotometric methods are inadequate as they do not provide a means for eliminating these interferences. Methods of analysis for nine trace metals are given here, wherein most of the interferences have been eliminated. The metals included are vanadium, iron, nickel, manganese, titanium, lead, copper, chromium, and platinum. The procedures are particularly adapted to the analysis of used petroleum catalysts and to the metallic residues from petroleum. All techniques involve spectrophotometric methods. Authors' Abstract

Vapor Pressure Testing

LeTourneau, R. L., Johnson, J. F., and Ellis, W. H. REDUCED-SCALE REID VAPOR PRESSURE APPARATUS. *Anal. Chem.*, 27, 142-44 (1955) January.

An apparatus to measure Reid vapor pressure of small samples consists of a sample cup to fix the liquid-vapor ratio and a pressure transducer to convert the pressure into an electrical equivalent, which is measured by an auxiliary detecting circuit. The range is 0 to 20 pounds. A sample of only 3 ml. is required. The time required to handle a sample properly and make a measurement is about one third less by this

method than by standard methods, and less bench space is required. The precision is as good as that of standard methods.

Authors' Abstract

Tomsic, W. J. DETERMINATION OF TRUE VAPOR PRESSURES. *Calif. Oil World*, 48, 1st issue, 1, 3, 5 (1955) January.

An apparatus and method for determining the true vapor pressure of hydrocarbon liquids have been developed. The test consists of superimposing an external pressure on the liquid in excess of the true vapor pressure; the pressure is then gradually reduced until the bubble point is reached as indicated by visual observation. The method is particularly useful for testing liquids, such as crude oil and lean absorption oil, containing traces of volatile components.

D. M. Mason

8. GENERAL AND PHYSICAL CHEMISTRY

Compressibility

Hall, N. A. and Ibele, W. E. COMPRESSIBILITY DEVIATIONS FOR POLAR GASES. Amer. Soc. Mech Eng. Paper No. 54-A-140 (1954) December.

Charts are presented which permit the calculation of compressibility factors for polar gases by applying a polarity correction to the compressibility as given by a standard chart.

R. F. Bukacek

Enthalpy Calculations

Weber, J. H. ISOTHERMAL ENTHALPY CHANGES. *Petroleum Processing*, 10, 83-85 (1955) January.

For engineering calculations it is frequently necessary to determine the isothermal enthalpy change for a hydrocarbon between two pressures. Berthelot's equation of state is a simple tool for this operation, requiring only that the critical temperature and pressure of the material be known. By use of the data from API Project 44, non-isothermal changes can also be determined. The method of use and an example and comparison of calculated values by various methods are given. B. E. Eakin

Phase Behavior

Davis, P. C., Bertuzzi, A. F., Gore, T. L., Kurata, F. THE PHASE AND VOLUMETRIC BEHAVIOR OF NATURAL GASES AT LOW TEMPERATURES AND HIGH PRESSURES. Amer. Inst. Min. Eng. Petrol. Branch T. P. 3917; Paper 365-G, Oct. 17-20 (1954).

The phase behavior and volumetric properties (tabulated as compressibility factors at reduced pressures and temperatures) of 10 mixtures of natural gas with methane and nitrogen for temperatures from —200° F. to above the critical points. Existing compressibility factor correlations have been extended to apply to these mixtures. Methods for estimating critical temperatures of these mixtures to ±4° F. and critical pressures to ±5 per cent that are applicable to other volatile mixtures were developed. The results of this work are particularly applicable to low-temperature separation of nitrogen from natural gas by distillation. B. E. Eakin

Reaction Rates

Elving, P. J. APPLICABILITY OF MEGACYCLE FREQUENCY OSCILLATOR CIRCUITS TO REACTION RATE MEASUREMENT. *Faraday Soc. Disc.* (British) No. 17, 156-67 (1954).

The application of high-frequency oscillators for the rapid measurement of electrical conductance to ionizable systems in aqueous solution is presented. In non-aqueous systems, megacycle oscillators can be used to follow both conductance and dielectric constant change. The general relation between high-frequency conductance is indicated. Critical factors involve oscillator type and frequency, cell design, and sample composition. Technique's greated limitation is that it measures only one physical property of the system. The hydrolysis of esters as followed by a high-frequency oscillator is described in detail to illustrate the method.

B. E. Eakin

Thermal Conductivity

Keyes, F. G. THERMAL CONDUCTIVITY OF GASES. Amer. Soc. Mech. Eng. Paper No. 54-A-235 (1954) November-December.

Tables and equations are given for the thermal conductivity of the following gases and temperature ranges: Argon 90-620° K, Krypton 130-580° K, Xenon 155-273° K, Nitrogen 90-823° K, and Oxygen 86-373° K. S. A. Weil

9. ORGANIC CHEMISTRY

Pitch Chemistry

Franck, H. G. DIE WAHRE NATUR DES STEINKOHLENTEERPECHS. (THE TRUE NATURE OF COAL TAR PITCH). *Brennstoff-Chemie*, 36, 12-20 (1955) January 12.

The principal uses of the 832,700 tons of pitch produced in 1953 in the Federal Republic were as binding agents, coating and building materials and in pitch coke. Composition and the basis for occurence of its characteristic properties have been unexplained to date. It is shown that pitch is a solid solution of many similar kinds of components whose binding properties are a result of an abundance of the above chemically similar components conditioned to a plastic state. About 90% of the pitch is composed of three- to seven-ring aromatics with a molecular weight between 170 and 380; the residue is of higher-molecular, soot-like compounds which are neither soluble or distillable and whose composition cannot be cleared up by chemical methods. As raw material for pure preparations, pitch has had to now no importance, but it is thought that some interest may arise in the easily recoverable fluoranthene. Compounds separated by various solvent extraction methods are listed and separation and properties of such extract-fractions are discussed. O. P. Brysch

Synthetic Detergents

Snell, C. T. and Snell, F. D. SYNDET MANUFACTURE FROM PETROCHEMICALS. *Petroleum Eng.*, 26, C7-10 (1954) December.

A description of the four steps required for the production of the sodium salt of sulfonated dodecyl benzene, the alkyl aryl type, is given. This salt makes up to 80 per cent of all petroleum-based detergents, or syndets.

E. Mann

Xylene Separation

Egan, C. J. and Luthy, R. V. SEPARATION OF XYLENES. *Ind. Eng. Chem.*, 47, 250-53 (1955) February.

The formation of an equimolal solid molecular compound with carbon tetrachloride affords an improved means of separating paraxylene from its isomers. This selective compound formation permits the more complete separation of the binary eutectic mixture of para and meta xylenes. Results of crystallization studies of several binary and other systems of CCl_4 with methyl benzenes are summarized, and application to refining of catalytic reformer stocks is suggested. O. P. Brysch

10. CHEMICAL ENGINEERING

Distillation Equilibria

Ellis, S. R. EQUILIBRIUM CALCULATIONS. *Chem. Eng. Science*, (British), 3, 287-293 (1954) December.

A simplified construction method for the solution of distillation calculations at constant molal overflow based on the difference-point technique similar to that of Ponchon and Savarit is obtained by using a reflux-concentration diagram. This method is applicable to the graphical stage-to-stage analysis of azeotropic, extractive, and multi-component separations, also for dilute solutions. The difference-point construction is common to most unit operation equilibrium calculations, such as adsorption, absorption, liquid extraction, leaching, and ion exchange.

B. E. Eakin

Dry Particle Mixing

Weidenbaum, S. S. and Bonilla, C. F. A FUNDAMENTAL STUDY OF THE MIXING OF PARTICULATE SOLIDS. *Chem. Eng. Progress*, 51, 27J-36 (1955) January.

A dry mixing operation has been studied to determine the degree of mixing, develop quantitative definitions of mixing and theoretical random equilibrium mixture, and devise a method for predicting the course of a mixing operation. Degree of mixing has been defined as the ratio of a theoretically calculated standard deviation for a randomly mixed batch to the experimentally determined standard deviation among spot samples. Experimental work for the study involved the mixing of —40+50-mesh salt and sand in a rotating horizontal cylinder. A rate equation has been proposed which was found to hold in the early portion of mixing operation with later deviation caused by an axial segregating driving force that opposes the mixing driving force of random motion.

E. J. Pyrcioch

Fluidized Reactor

Leffer, F. A. (assigned to Universal Oil Products Co.) METHOD AND APPARATUS FOR THE CONTINUOUS CONTACTING OF SUBDIVIDED SOLID PARTICLES SUCCESSIVELY WITH AT LEAST THREE FLUID REACTANT STREAMS. U. S. 2,698,281 (1954) December 28.

This patent describes a combination fluid vessel having three stages arranged concentrically, consisting of the reaction zone, and first and second stage oxidizing zones.

C. G. von Fredersdorff

Heat Exchangers

Grahl, E. R. 'STEP-WISE' HEAT TRANSFER CALCULATIONS. *Petroleum Processing*, **10**, 61-69 (1955) January.

A method is presented for calculating the dimensions of heat exchangers that includes the changes in physical properties of the fluids with temperature. Whenever fabrication material costs exceeds three-fold, this technique will give a much more accurate estimate of the required dimensions. When heat exchanger costs are compared to possible process down-time, the extra design time required by this method is well invested. A sample calculation is presented.

B. E. Eakin

Van Deemter, J. J. HEAT AND MASS TRANSPORT IN A FIXED CATALYST BED DURING REGENERATION. *Ind. Eng. Chem.*, **46**, 2300-02 (1954) November.

In a previous paper by this author, the transient longitudinal temperature profile during the regeneration of a fixed catalyst bed has been derived mathematically under the assumptions of a constant reaction rate in an adiabatic reactor with an infinitely high gas-particle heat transfer coefficient but with no heat transfer and no variation in gas density in the longitudinal direction. It is shown that there is a critical oxygen concentration above which 1) the velocity of the oxidation zone is equal to the velocity of heat transfer by convection in the bed and 2) the temperature in the oxidation zone increases linearly as the zone proceeds through the bed. Below the critical oxygen concentration, the velocity of the oxidation zone is smaller than that of heat transfer. Under these conditions, the complicated temperature distribution may be more easily obtained by graphical construction rather by mathematic analysis. In this paper, graphical illustrations have been given for two cases: oxygen concentrations equal to ⅔ and ⅓ of the critical; general expressions for bed temperature have also been obtained. From these expressions it is observed that the oxidation zone temperature initially increases linearly until at a definite distance from the entry a certain maximum value is attained. This maximum is independent of the reaction rate and gas velocity, while the distance at which the maximum occurs is inversely proportional to the reaction rate and directly proportional to the gas velocity. Both the maximum temperature and the inlet distance may be easily controlled by adjusting the oxygen concentration.

S. Hu

Vessel Design

Downey, W. P. RIGGING AND REFINERY CONSTRUCTION ECONOMICS. *Petroleum Eng.*, **26**, C11-16 (1954) December.

Proper consideration of erection techniques to be employed for large vessels in plant construction will save much time and money. In certain cases design changes are dictated by available erection methods.

W. G. Bair

Stafford, P. M. RATIONAL THICKNESS DESIGN FOR PRESSURE VESSELS. Am. Soc. Mech. Eng. Paper No. 54-A-84 (1954) November-December.

In pressure-vessel design above certain proportions, the usual methods of providing for increased load capacity cannot be applied economically. Appreciable improvements in material economy can be accomplished by shrink-fit construction of pressure vessels requiring diameter ratios in excess of $R = 2.5$. A method for computing rational shrink-fit dimensions is presented. An example is demonstrated in which a reduction of wall thickness from 9.25 in. to 5 in. is accomplished. In this case, the working pressure and design stress are, of course, unchanged. No claim is made, however, that the method will result in the maximum material economy that may be possible.

Author's Abstract

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Computer Applications

Beutler, J. A. PROGRAMMING OF KINETIC CALCULATIONS FOR AUTOMATIC COMPUTATION. *Chem. Eng. Progress*, 50, 569-74 (1954) November.

The use of a large scale high-speed electronic digital computer for the solution of the differential equations describing the kinetics of a chemical-reactor system is presented. The equations and the method of solution used for this problem and the manner in which the machine was programmed are outlined. A method of determining the cost per solution for a digital computer problem application is given. The computer used was the M.I.T. Whirlewind, capable of more than 20,000 information operations per second. B. E. Eakin

Fritz, N. L. ANALOG COMPUTER FOR NONLINEAR COORDINATE TRANSFORMATION. *Rev. Sci. Instr.*, 26, 23-27 (1955) January.

Transformations in multicomponent analysis are frequently better represented by second-degree simultaneous equations than by linear equations. A set of equations requiring constant coefficient terms can be set into an analog computer which gives good results quickly and accurately. The computer described will evaluate three second-degree equations with an accuracy of better than 0.2 per cent of maximum value. B. E. Eakin

Gee, R. E., Linton, W. H., Jr., Maier, R. E., and Raines, J. W. USE OF COMPUTERS IN KINETIC CALCULATIONS. *Chem. Eng. Progress*, 50, 497-502 (1954) October.

The purpose of this paper is to show how the general practitioner in chemical engineering can make more use of applied kinetics in industrial work. The material is not aimed primarily at the kinetics specialist, although he might find the approach useful. In most industrial work the use of sound applied kinetics has been limited too frequently by the mathematical complexities which force the engineer to make many undesirable simplifying assumptions. This means that the practicing engineer does not make sufficient use of the fundamental academic work in kinetics, particularly in combining concepts from several idealized systems with his admittedly complex, practical system. The authors hope by the example given here to show that large computers, which are now available, permit the general practitioner to make more use of reaction kinetics. A companion paper by J. A. Beutler on programming for such computation will appear in a later issue.

Authors' Abstract

Müller, R. H. INSTRUMENTATION. *Anal. Chem.*, 26, 35A, 36, 38 (1954) December.

For some strange reason acoustical analysis based upon the velocity of sound through a system has been almost completely ignored. The only commercial applications at present are in the acoustic gas analyzer used in anesthetic mixture control (air, ether, oxygen). This should be a promising field of investigation. The need for small-scale digital or analog computers for calculation of particular values from experimental data is being experienced. Much time is presently being spent by research men in computing values required in their calculation from reported experimental data that is not in the most useful form. Many of the equations involved are simple, but time consuming when done by hand. Any of the large computers can do these simple calculations, but the investment involved is out of line with the requirements. B. E. Eakin

Flow Meters

Buckingham, E. NOTES ON SOME RECENTLY PUBLISHED EXPERIMENTS ON ORIFICE METERS. Amer. Soc. Mech. Eng. Paper No. 54-A-244 (1954) November.

A paper prepared but not completed by E. Buckingham before his death in 1940, with remarks by Howard S. Bean. A procedure for plotting orifice coefficient data which results in straight lines over a considerable range is presented and equations for representing coefficients are given with an analysis of the effect of orifice plate and edge finishes.

R. F. Bukacek

Ezekiel, F. D. A NEW TYPE OF FLOWMETER FOR COMPRESSIBLE FLUIDS. Amer. Soc. Mech. Eng. Paper No. 54-A-149 (1954) November.

An orifice meter with spring or bellows acti-

vated plunger for orifice size variation is described; its theory, construction and operation. At present its use is not likely for large-volume metering. R. F. Bukacek

Miner, I. O. THE DALL FLOW TUBE. Amer. Soc. Mech. Eng. Paper No. 54-A-139 (1954) November.

A report on the characteristics of the Dall Flow Tube as determined by tests on the flow of water. The Dall Flow Tube is a modified venturi tube exhibiting low head loss and high differential characteristics. The device appears to have application to gas flow metering with the low head loss offering a saving in compression costs. R. F. Bukacek

Rivas, M. A., Jr. and Shapiro, A. H. ON THE THEORY OF DISCHARGE COEFFICIENTS FOR ROUNDED-ENTRANCE FLOW-METERS AND VENTURIS. Amer. Soc. Mech. Eng. Paper No. 54-A-98 (1954) November.

A theoretical treatment of rounded-entrance flow meters is presented for incompressible steady flow, where there is a smooth contraction from large diameter to small diameter and following the contraction there is a short length of constant-diameter pipe preceding the downstream static-pressure tap. R. F. Bukacek

Plug Valves

Alorfer, H. A. LUBRICATED PLUG VALVES. *Heating and Ventilating*, 51, 68-70 (1954) December.

Data is given pertaining to the design, use and maintenance of lubricated plug valves comprised of three basic parts and employing the pressure-lubrication principle that gave impetus to wide spread application. S. Volchko

Recording Balance

Caule, E. J. and McCully, G. AN AUTOMATIC RECORDING ANALYTICAL BALANCE. *Can. J. Techn.*, 33, 1-11 (1955) January.

The design, construction and operation of an automatic recording balance is described. The controller-recorder may be attached to an analytical balance, or any other fine balance, and no mechanical changes in the balance are required. The sensing element consists of a fixed primary and a moving short-circuited secondary coil, the separation of which gives a measurable variation in self-inductance. D. J. Dennison

12. MATERIALS OF CONSTRUCTION

Concrete Aggregates

Southworth, G. B. CONCRETE MIXING AND PLACING. 11. DESIGN AND CONTROL OF CONCRETE MIXES. *Construction*, 37, 102, 3, 6, 8, 111, 13, 14, 17, 18, 19, 122, 24, 25 (1955) January.

The selecting of aggregates and proportioning of materials for making mixes of various strengths is discussed. S. Volchko

Organic Coatings

Seymour, R. B. NEOPRENE: IS IT THE BEST ALL-AROUND ORGANIC COATING? *Materials and Methods*, 40, 93-95 (1954) December; NACE Paper (1954) March 15-19.

By rating ten organic coatings from 1 to 10 on costs, ease of application, resistance to temperature, weather, solvents, salts, acids, with 10 being the optimum value, neoprene is found to give highest summation of ratings. Neoprene has 2nd highest cost per gal, but lowest cost per coat and per yr.; best temperature, salts and alkali resistance. It is poor against solvents, where *epoxy* is best. O. P. Brysch

Plastic Pipe

Jacobson, W. E. FACTS ABOUT PLASTIC PIPE. *Air Conditioning, Heating and Ventltg.*, 52, 87-91 (1955) January.

The corrosion and chemical resistance, light weight, reduced flow friction and easy installation of plastic pipe has encouraged its rapid adoption in many applications, where its limitations in tensile strength, working pressures and temperatures were not too restrictive. The principle types,—including polyethylene, cellulose acetate butyrate, polyvinyl chloride, styrene copolymer and vinylidene chlorides,—are discussed from the standpoint of proper selection for special applications. Sizes, fittings reinforcement, expansion, safe pressures, research and standards are outlined. O. P. Brysch

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